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bearing, and Petite Anse lay right in the line of a series of Cretaceous outliers indicating an axis of upheaval, Cretaceous limestone occurring within sixty miles of Petite Anse. Moreover, the limestone and gypsum of Calcasieu, between which lies the sulphur bed, are distinctly represented in the Cretaceous of northern Louisiana, while totally foreign to any of the Tertiary stages; and although the great gypsum bed has not been reached at Petite Anse, it lies in the proper line of dip, and seems to form a complement to be looked for, of the great rocksalt bed. These probabilities fall short of proof, it is true, but weigh heavily when we consider the simplicity of the geological structure of the Mississippi embayment; where departures from the general rule are so unlikely as to throw the burden of proof upon whosoever maintains their existence.

#### ON THE CARPAL AND TARSAL BONES OF BIRDS.—BY PROF. EDWARD S. MORSE.

THE author stated that he had followed with great interest the work of Huxley, Cope, and others in tracing out the ornithic characters in the Dinosauria. While following these relations he had noticed a marked difference in the characters of the carpus and tarsus of the two classes. It seemed strange that a group of bones so persistent in the reptiles as well as in the mammalia should be so obscure or wanting in birds. Owen objects to the term tarso-metatarsal as he believes the existence of a tarsus has not been demonstrated. W. S. Parker, in 1861, on the osteology of *Baloeniceps*, questions if the lower articular portion of the tibia is not the homologue of the mammalian astragalus and not an epiphysis. Gegenbaur has now shown that in one stage of the young bird there is a proximal tarsal ossicle, and a distal tarsal ossicle, the first one ankylosing with the tibia, the distal one likewise ankylosing with the metatarsal. Thus, the term tarso-metatarsal is quite proper. While this was a great step toward a proper understanding of these parts, Mr. Morse believed that a nearer relation would be found in the discovery of another proximal tarsal bone. In those reptiles he had examined, whatever the number of tarsal bones, there were always in the proximal series one corresponding to the tibia, and another corresponding to the fibula. He had found this feature in birds. In studying the embryos of the eave swallow, bank swallow, king bird, sand piper, black bird, cow black bird, blue bird, chirping sparrow, yellow warbler, and Wilson's thrush, he had found three distinct tarsal bones, two in the proximal series answering to the tibia and fibula, and one in the

distal series. The first two early ankylose, and present an hour-glass-shaped articular surface as Prof. Cope has described in the astragalus of *Leclaps*. The final ankylosis of these conjoined ossicles with the tibia, formed the bicondylar trochlea so peculiar to the distal end of a bird's tibia. The distal tarsal ossicle became united with the proximal ends of the metatarses as has been shown. In the carpus he had found four perfectly distinct ossicles, the distal carpal bones becoming united to the base of the mid- and outer metacarpals, the other two remaining free, though the ulnar carpal in some cases ankylosed with the ulna. In the king bird and yellow warbler, he had found a fifth carpal on the radial side.

Mr. Morse also described the pelvic bones of an embryo sparrow, though he supposed these had already been worked up.

When Professor Morse mentioned his doubt about the natural position of the ischium of a certain saurian with reference to a lateral process of the same, Dr. T. C. HILGARD remarked that every pelvis consisted, besides the sacrum, of five, not three only, separate bones on either side; the *crista ilei* being, in mammals (*i. e.* young dog), a separate, crescented rim, sutured to the hip-blade; and, in a like manner, the *tuberositas ischii* was related to the *ischium*. They are the fourth and fifth elements, which by the genetic law of numbers, ought actually to have sprung from the first (*ischium*) and second (*ileum*), respectively, to which they adhere. The third bone was the *os pubis*. In birds, the *tuberositas* forms a gristle, which, in "spring-chickens," is seen ossified as a bone or process, etc., connecting the ischium sidewise with the rearward prolongation of the ileum, and forming a recess for the attachment of a pelvic muscle. In chickens this bone takes the shape of a boomerang, and perhaps the Polynesians found that instrument ready made in the "spring-dinornis." It forms various processes according to the first location of its nucleus.

Dr. C. A. WHITE, asked if no attempt had been made to specially homologize these carpal and tarsal bones of birds. Since those adjacent both distally and proximally had been thus homologized, it seems as if it would not be very difficult to do the same for the smaller bones of the carpus and tarsus. Perhaps they may, just before they ankylose, present pseudoarticular facettes that will give a valuable clue to their special homologies by comparison with similar parts of limbs of mammals.